Space Weather Technical Forecast

Issued on Tuesday, 31 October 2023 at 01:03 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of G1/Minor Storms on 31 Oct. Chance of Active fluence from 31 Oct onwards.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with only low-level C-class flares observed, all emanating from AR3474 in south-centre disc. This region has matured and stabilised after development in the previous 24 hours, and is the largest and most complex region on the visible disc. Two other regions in the northern hemisphere have weakened after a brief period of increased complexity. No Earth-directed CMEs have been observed on available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed at L1 have followed a steadily declining trend as the high speed stream from coronal hole 66 begins to wane, reaching 520 km/s by the end of the period. Density has been steady but below average. Total magnetic field strength has continued at weak levels. The north-south component, Bz, has varied at weak levels. Phi angle was predominantly negative (away from the Sun). Geomagnetic activity started Active, but has declined to Quiet to Unsettled levels.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux started at moderate levels, but reached a peak 2100 pfu at 30/1615 UTC. The electron flux has since returned to moderate levels. The associated 24-hour fluence remains below the Active (1e8 integrated pfu) threshold but on a rising trend, peaking at 7.98e7 integrated pfu at 30/2359 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is expected, with a slight chance of Moderate activity, especially from AR3474.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are forecast. The high speed stream from coronal hole 66 is forecast to steadily wane towards slightly elevated or background levels through the next four days as the coronal hole rotates towards the western limb. No further coronal holes are visible in the western hemisphere. Unsettled to Active intervals are forecast on 31 Oct, with a very slight chance of G1/Minor Storms at the start of the period. Activity is the expected to decline towards Quiet levels by 03 Nov.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background. High energy electron flux (greater than 2MeV) is forecast to oscillate between moderate to high levels. Associated 24 electron fluence is expected to see a rising trend, and is expected to reach Active levels (>1e8 integrated pfu) by either 02 or 03 Nov.

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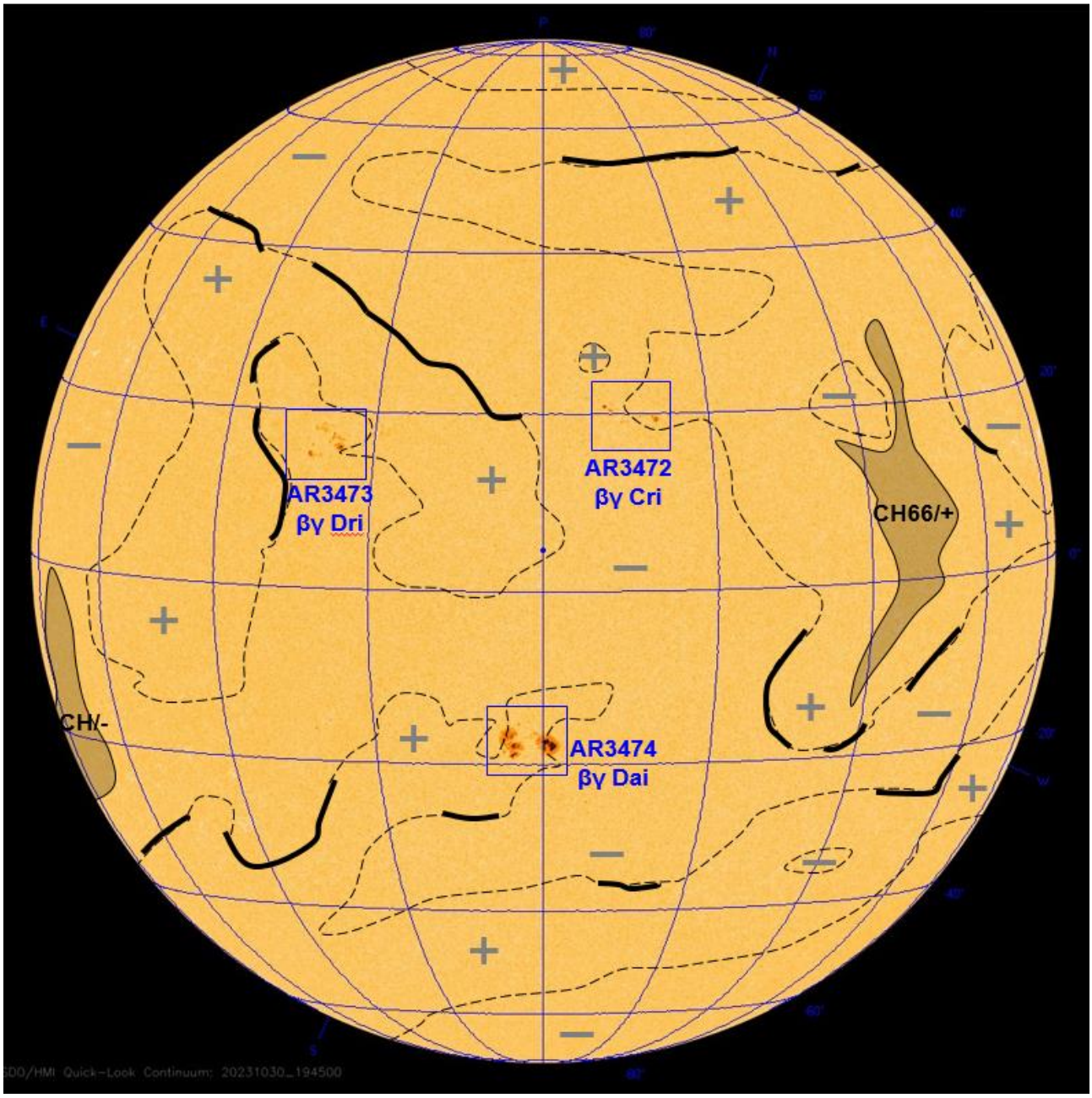
Figure 1. Solar Analysis Valid 30/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

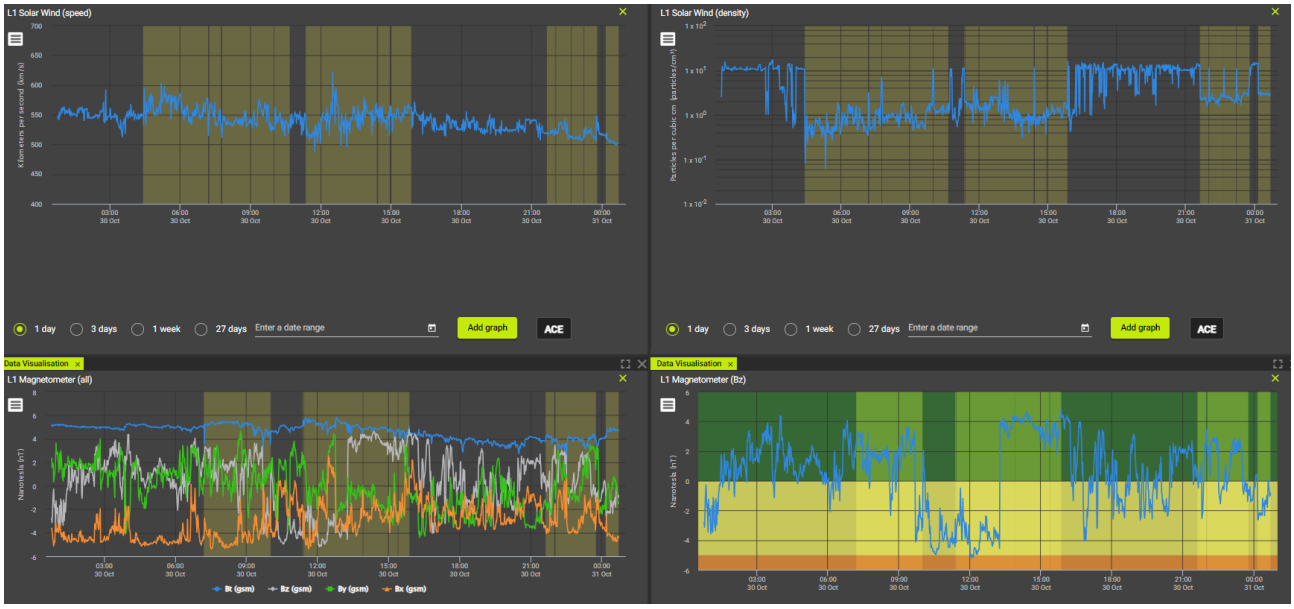
No Earth-directed CMEs are forecast over the next four days.

Solar wind speeds are elevated but on a steadily declining trend as the high speed stream from coronal hole 66 eases. Speeds are likely to trend towards slightly elevated levels by the end of the period.

Unsettled geomagnetic activity is expected, with a slight chance G1/Minor Storms at first on 31 October, but then mainly Quiet with isolated Unsettled intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Solar wind parameters observed at L1.



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Only three sunspots are on the visible disc. AR3474 in the south-centre disc has stabilised after significant development in the last 24 hours, where it produced a series of C-class flares. The remaining regions are both weakening after some limited development over the last day. Analysis of farsided imagery suggested that further significant regions may rotate onto the visible disc in the next three days.

Low activity is forecast, with a slight, but increasing chance of M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	25	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant sunspot regions within the western hemisphere of the visible disc.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	2	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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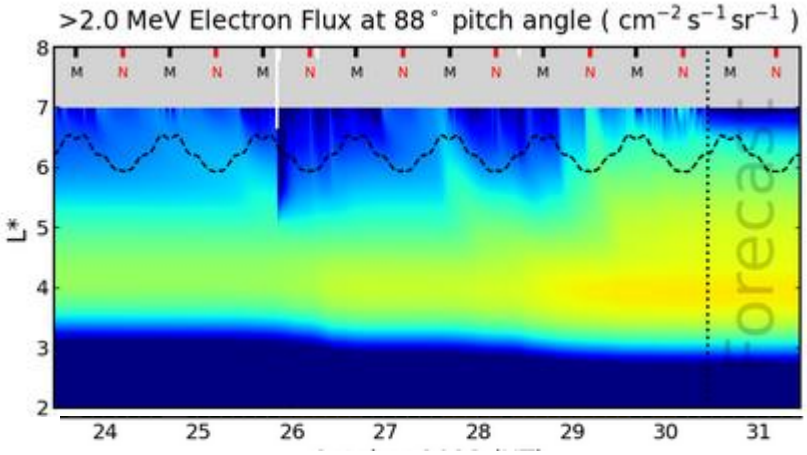
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) is expected to vary between moderate and high levels through the next four days on diurnal trends. This is due to increased population of the belts from the ongoing high speed stream. In the absence of significant geomagnetic activity and with declining solar wind pressure the high levels are likely to be sustained, with an increase in diurnal peaks.

Electron fluence is forecast to increase through the next four days due to the increased electron flux and is expected to exceed the Active threshold by 02 Nov.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	50	60	70	80
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: British Antarctic Survey Radiation Belt Model, showing the forecast expansion of the radiation belts across the orbit of GOES 16 (indicated by the dashed line) towards the end of the period. L* is equivalent to Earth radii.



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